Q4.1

Concentrations of Solutions Pg. 203

Concentration: a measure of the amount of Solute that is dissolved in a given quantity of Solvent

Salt + water ⟶ Saltwater

Solute Solvent Solution

dilute solution: a solution with a small amount of solute

Concentrated solution: a solution with a large amount of solute

Molar Concentration (Molarity): is the number of moles of solute dissolved in 1L of solution

$M = mol/L$

to calculate molarity:

$$M = \frac{\text{moles of Solute}}{\text{liters of solution}}$$

Making a 0.5 M solution:

1. Volumetric flask (1L) filled halfway of DI water
2. 0.5 mol of Solute
3. Mix Solution to dissolve the solid solute
4. Fill the flask with DI water to the 1L mark

Calculating Molarity:-

one Saline Solution Contains 0.90 g NaCl in exactly 100mL of Solution. what is the molarity of the Solution?

Concentration = 0.90 g in 100 mL

molar mass NaCL = 58.5 g/mol

$$\frac{0.90\ g}{100\ mL} \times \frac{1\ mol\ NaCl}{58.5\ g\ NaCl} \times \frac{1000\ mL}{1L} = 0.15\ mol/L$$

Calculating Moles of Solute in Solution

Example :-
Household laundry bleach is a dilute aqueous solution of sodium hypochlorite (NaCl). How many moles of solute are present in 1.5 L of 0.70 M NaClO.

Molarity = 0.70 M = 0.70 mol/L
Volume = 1.5 L

$$1.5\,L \times \frac{0.70\,mol}{1\,L} = 1.05\,mol = \boxed{1.1\,mol}$$

Q1) How many moles of ammonium nitrate are in 335 mL of 0.425 M NH_4NO_3 ?

Molarity = 0.425 M
Volume = 335 mL

$$\frac{335\,mL}{1000} \times \frac{0.425\,mol}{1\,L} = 0.14\,mol$$

Q2) How many moles of solute are in 250 mL of 2.0 M $CaCl_2$?

Molarity = 2.0 M
Volume = 250 mL

$$\frac{250\,mL}{1000} \times 2.0 = 0.5\,mol$$

Adnan was here! :)

Pg. 206

Dilutions:

dilute a solution by adding more solvent

→ number of moles of solute doesn't change

→ number of moles of solvent does change

$$\text{moles of solute} = \underset{\text{molarity}}{M} \times \underset{\text{volume}}{V}$$

Stock solution: a concentrated solution of known molarity that is diluted to make less concentrated solutions

$$\text{moles of solute} = \underset{\text{stock}}{MV} = \underset{\text{dilute}}{MV}$$

Example:

You have a stock solution of questions 2.0 M $MgSO_4$. How many mL must be diluted w/water to prepare 100.0 mL of aqueous 0.400 M $MgSO_4$?

$M_S = 2.0\ M$

$M_D = 0.400\ M$

$V_D = 100.0\ mL$

$$V_{stock} = \frac{M_D V_D}{M_S}$$

$$V_S = \frac{(0.400)(100.0)}{2.0} = \boxed{20.0\ mL}$$

Precent solution:-

if both solute and solvent are liquids, a way to make a solution is to measure the volumes of the solute and solution.

$$\text{Precent by Volume} = \frac{\text{Volume of Solute}}{\text{Volume of Solution}} \times 100$$

↳ the ratio of the volumes of solute to solution

$$\text{Precent by mass} = \frac{\text{mass of solute}}{\text{" of Solution}} \times 100$$

↳ the ratio of the masses of the solute to solution.